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Validating an Observational Coding System for the Dominance Behavioural System (DBS) in Childhood

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A thesis submitted in partial fulfillment of the requirements for the Master of Science degree in Psychology

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Abstract

The dominance behavioural system (DBS) is a biologically based system that underpins individual differences in motivation for dominance and power. However, little is known about the DBS in childhood. In a pilot study aimed at developing a behavioural coding system for dominance, a key facet of the DBS, we collected and coded observational data from 58 children, assessed at ages 3 and 5-6. Between these ages, dominance was moderately stable, to a degree comparable to other early child temperament traits. Consistent with study hypotheses, boys were more dominant than girls, and dominance was negatively associated with children's behavioural inhibition, effortful control, and internalizing symptoms. These results provide initial support for the validity and developmental sensitivity of an objective coding system for assessing facets of the DBS in early childhood. Ultimately, the use of this coding system will facilitate future studies of how early DBS predicts psychological adjustment later in life.

Keywords: dominance, children, development, measurement, observational, assessment

Lay Summary

Humans vary in their motivation for dominance and power. This variation has been linked to various mental health problems in adults; for example, those who have an excessive desire to avoid dominance and power may be more likely to suffer from depression and anxiety. However, less research has been done on childhood dominance, leaving it unclear when meaningful differences in dominance emerge. We therefore measured dominance in young children through a new method in which children were rated on dominance during standardized laboratory tasks. We found that dominance was relatively stable across a time period of 2 years in early childhood (between the ages of 3 and 5-6) and that children's dominance, like dominance in adults, was negatively associated with depression and anxiety. We also found that boys tended to be more dominant than girls. These results a) support the use of observational coding as a valid indicator of dominance in children, and b) provide information about how patterns of dominance emerge early in life. Our hope is that this coding method will facilitate future studies of how early dominance predicts mental health functioning later in life.

Co-Authorship Statement

This thesis contains material from a manuscript bearing the same title that was submitted for publication. The manuscript with coauthored by Jennifer Mullen, Dr. Pan Liu, Dr. Christina McDonell, Dr. Kasey Stanton, Dr. Yuliya Kotelnikova, Dr. Sheri Johnson, and Dr. Elizabeth Hayden. Jennifer Mullen was the primary author and was responsible for the analysis and interpretation of research data and preparation of the manuscript. Dr. Yuliya Kotelnikova assisted in data collection. Dr. Liu and Dr. McDonell assisted with coding the behavioural data. Dr. Stanton and Dr. Johnson contributed to the conceptualization of the study, the interpretation of results, and manuscript development. Dr. Hayden is the Principal Investigator of the larger study, led the conceptualization of the study, assisted in both the interpretation of results and manuscript development.

Acknowledgments

First and foremost, I would like to acknowledge the appreciation I have for my supervisor, Dr. Elizabeth Hayden. Your extremely supportive demeanor, intelligence, and wonderful sense of humour made this work not only possible, but enjoyable. I feel very lucky to have had you as such an encouraging supervisor during this time and look forward to working with you in the years ahead.

I have immense gratitude for each and every member of the Hayden Lab: Matt, Ola, Andrew, Lindsay, and Pan, who gave me the warmest welcome upon my arrival two years ago, and our newer members, Emma and Haley. Although my *physical* time in the lab was quickly interrupted by a pandemic, you all continued to make me feel completely supported, offering quick responses or Zoom calls at the drop of a hat if I had a question or concern. Our lively Google chat, meme-sharing, lab meetings, and Zoom lunches have brought joy to many of my days over the past year and a half.

I would like to thank my wonderful group of friends, who have consistently supported me, inspired me, and provided me with so much love and laughter. You all provide the "life" to my "work-life balance." To my partner Braeden, who has listened to me describe iterations of this project in detail since its inception, thank you for your patience, compassion, genuine interest, and unwavering encouragement.

Lastly, a huge thank you is in order to my parents and my sister Laura, who have always inspired me to follow my dreams, no matter how unattainable they may feel to me in that moment. At times, you have believed in me more than I have believed in myself, and for that, I am forever grateful.

Table of Contents

List of Tables

List of Appendices

1. Introduction

Human variation in dominance has evolved in the context of social hierarchies, serving a critical role in survival and reproduction. Dominance and related constructs have been studied from many vantage points, from behavioural ecology to personality psychology, under an array of different labels (Bugental, 2000; Shaver et al., 2011; Zuroff et al., 2010). In personality psychology, trait dominance is a critical component of the dominance behavioural system (DBS), originally described by Johnson and colleagues (2012). In this model, the DBS is a biologically based system that gives rise to individual differences in motivation for dominance, dominant behaviour, and responsiveness to cues of power (Johnson et al., 2012).

Recent interest in individual differences in the DBS in is reflected in a small yet growing body of research focusing on its relations to an array of adaptive and maladaptive outcomes (Johnson et al., 2012; Tang-Smith et al., 2015; Stanton, 2017; Tharp et al., 2021). Johnson and colleagues (2012) reviewed the relevant literature in adults relatively recently, providing a summary of the correlates of the DBS with biological and affective processes and psychopathology. The goal of the review that follows is to familiarize the reader with the relevant developmental and trait literature on dominance, providing an overview of issues in the assessment of the DBS and illustrating how the study of DBS will benefit from a developmental perspective[1].

Research using self-report and observational approaches shows that elevated DBS and related constructs are associated with externalizing problems in adults, including psychopathy

[1] The current review includes research focusing specifically on the DBS but also the much larger body of research focused more narrowly on dominance, the key facet of the DBS.

(e.g., Hall et al., 2004), substance use disorders (e.g., Krueger et al., 1996), and narcissism (e.g., Bradlee & Emmons, 1992). In addition, the DBS is negatively associated with internalizing disorders, such that low dominance, or high submissiveness, have been associated with depression and anxiety (e.g., Gilbert, 1992, 2000). Indeed, trait dominance may partially account for the widespread comorbidity of internalizing disorders across the population (Johnson et al., 2012), given that both anxiety and depressive disorders are characterized by withdrawn and submissive behavior in the context of social interactions (e.g., Allan & Gilbert, 1997; Gilbert et al., 2002; Gilbert et al., 2009). However, these findings are drawn from research on adults, with virtually nothing known about the development of the DBS in early childhood.

Theories of the DBS assert its strong biological bases (Johnson et al., 2012), suggesting that it should emerge and become relatively crystallized early in development. While developmental psychology has not focused on the DBS per se, there is a relevant literature focused on social dominance studied within groups of children (e.g., Hawley, 2002; Hawley, 1999). Individual differences in social dominance (typically operationalized as children's "resource-control behaviour," referring to behaviors such as initiating, leading, or coercing others [e.g., Charlesworth, 1988; Hawley & Little, 1999; Pelligrini, 2008]) are observable as early as toddlerhood. Much of the work in this area has focused on discriminating between aggressive vs. prosocial or affiliative dominance strategies during development, showing that aggressive or coercive strategies are most often used by children to gain resources, and young children who exhibit these behaviours are the most watched and liked by their peers (Hawley, 2002; Strayer & Trudel, 1984). By the third grade, however, children who assert resource-control strategies solely by aggressive or coercive means are viewed negatively by peers (Hawley, 1999).

The developmental literature has also explored sex differences in dominance behaviour in the early years. Beginning in preschool, girls and boys socialize primarily in same-sex groups (Benenson, 1994; Martin & Fabes, 2001), and considerable evidence indicates that this leads to gender-specific behaviours within peer groups (Maccoby, 1990). The literature examining differences between boys and girls in early social dominance has explored differences in resource-control strategies rather than in trait dominance. Early work indicated that boys and girls did not differ in their overall number of bids for dominance, but instead in the types of dominance behaviour used, such that boys were found to be more aggressive and girls more verbal (Charlesworth & Dzur, 1987). Much of the relevant research on childhood dominance is several decades old, with newer work focusing on distinguishing between boys' and girls' social dominance and competence (i.e., the ability to obtain resource-control *while* maintaining positive social relationships). For example, Sebanc et al. (2003) found no differences between boys and girls in the types of dominant behaviours used, but rather, differences in how accepted such behaviour was amongst peers. In the personality literature, boys have been shown to have higher dominance-related traits than girls, such as "Activity", across early and middle childhood (e.g., Soto, 2016). In adults, personality research indicates that, across cultures, men are generally more aggressive and women are more submissive (e.g., Costa et al., 2001). In addition, most work shows that women tend to have lower social dominance orientation (i.e., an individual's preference for social hierarchy and the extent to which they desire "in-groups" to be superior to outgroups; Pratto et al., 1994) than men (Foels & Reid, 2010), suggesting that adult males may have higher trait dominance than adult women. It remains unclear, however, when differences in dominance emerge in development.

Extant research on trait dominance is characterized by a wide range of measurement approaches and rating systems. Johnson and colleagues (2012) provide a detailed review of the methods used to index facets of the DBS in adults, which include self-report, implicit tasks (i.e., capturing automatic processes), observational measures, and indices of relevant psychophysiological processes. Currently, self-report measures are the most popular approach to measuring the DBS in adults, given that they are the standard approach to assessing virtually all individual difference factors in adulthood due to their ease of administration and interpretation. However, self-reported ratings of DBS and relevant constructs are but one vantage point and may be susceptible to bias; for example, self-reported dominance ratings have been found to correlate with overly positive self-ratings of task performance as compared to objective assessor ratings (Jackson et al., 2007), as well as measures of social desirability (Mehrabian, 1996). Of import, self-report measures cannot readily be used with young children, limiting their use in developmental studies of the DBS. The tools used to assess dominance in children are generally designed for its study within a narrowly defined age range (e.g., Preschool Competition Questionnaire, Paquette et al., 2013), limiting the ability to assess the development of trait dominance over time using comparable measures. Thus, developmental studies of the DBS in childhood may benefit from methods designed to tap individual differences in early emerging traits across early childhood.

Observational laboratory measures are well-suited to address these aforementioned concerns. Laboratory tasks use standard stimuli designed to elicit behaviours of interest, which provide the opportunity to observe individual differences in a standardized context. In addition, laboratory tasks are coded by independent coders using objective criteria, avoiding the parental biases in reporting that may influence parent reports (e.g., Hayden et al., 2010). The use of

observational methods also circumvents the challenge of young children not yet having the linguistic and/or cognitive ability to self-report on their own behaviour. In the developmental literature, observational laboratory tasks have a long and rich tradition (e.g., Hartmann & Wood, 1990; Kochanska et al., 1997), and a handful of studies have used such approaches to assess aspects of the DBS (Johnson et al., 2012); however, to our knowledge, no studies have used observational measures to examine the early development and stability of dominance.

Such methods may help to address several key gaps in the literature on dominance. In particular, the study of trait dominance from the DBS as an early emerging temperamental constellation of traits is limited. Whether dominance shows stability early in development is unclear; however, early emerging stability is a defining aspect of temperament (e.g., Roberts & DelVecchio, 2000; Shiner et al., 2012). In addition, it is unclear whether early dominance is sufficiently distinct from other, more thoroughly studied childhood traits to warrant its own research literature. There is conceptual overlap between dominance and behavioural inhibition (BI), which describes the tendency to show reluctance, withdrawal, and fearfulness in the presence of unfamiliar stimuli (Kagan et al., 1984). Given that expressions of dominance involve approach-related behaviours, such as initiation, leadership, and in some cases, aggression, BI and dominance are likely negatively correlated, given that BI is defined by inhibition of behaviour. However, submissiveness (i.e., low dominance) reflects low motivation to pursue power rather than anxiety related to the approach behaviours needed to achieve power (Johnson et al., 2012); therefore, BI and dominance should be somewhat distinct from one another. Relatedly, effortful control (EC) (i.e., the ability to inhibit a dominant response and activate a subdominant response) is conceptually related to dominance, in that low EC and high dominance are likely to be associated with elevated activity. Supporting this notion, children's low EC (Eisenberg et al., 2005) and high

DBS in adulthood (Johnson et al., 2012) are implicated in externalizing disorders, albeit for different underlying reasons. Specifically, trait EC reflects individual differences in self-regulation whereas dominance emphasizes drives for power. For these reasons, while low EC and heightened dominance may both manifest as under controlled behaviour, they are conceptually distinct.

Based on this literature, we explored the utility of observational laboratory approaches to assessing dominance, a core feature of the DBS, in early childhood. Because some facets of the DBS require contemplation of internal states and desires (i.e., dominance motivation and self-perceived power) and are therefore likely challenging to assess in early childhood, we focused on coding overt dominance behaviors as a preliminary step in validating this method, using an adapted version of a trait-based rating scale (Interpersonal Adjective Scales – Revised [IAS-R]; Wiggins et al., 1988). To position our index of dominance within a broader nomological network, we examined correlations between dominance and other child temperament traits, as well as child psychopathology symptoms, given the literature linking adult DBS to psychopathology (see Johnson et al., 2012).

The purpose of this study was to gather preliminary descriptive data to direct future measurement development, rather than testing theoretical models. Notwithstanding the limited existing literature in mind, we hypothesized that (1) dominance would be relatively stable across a time period of approximately 2.5 years; (2) boys would be more dominant than girls, (3) dominance would be moderately negatively correlated with BI and EC, and (4) dominance would be positively correlated with children's externalizing problems and negatively correlated with internalizing problems. We examined these issues in a small pilot study of families as an initial, exploratory "proof of concept" study to speak to the potential value of applying observational methods to the study of the development of early trait dominance.

2. Methods

2.1 Participants

Participants were 58 families (mother-father dyads and their children) recruited from an ongoing study of child emotional development. The larger study consisted of 409 families of typically developing three-year-olds at baseline (Kryski et al., 2011). A subset of 58 families was recruited for more extensive observational assessments of temperament and personality. Data for the current study were drawn from two waves of assessments occurring when children were approximately three (T1; N = 58, 30 girls, M_{age} = 3.46, SD = .29) and five to six years of age (T2; N = 58, 30 girls, M_{age} = 5.95, SD = .31). Children in this sample were predominantly White (91.4%), as identified by their caregiver. Approximately 52.8% of families were middle-class with an annual family income of $40,000-$100,000 CAD (9% with income <$40,000; 38.2% with income >$100,000). Children were of average cognitive ability based on a receptive vocabulary test completed at age three (Peabody Picture Vocabulary Test [PPVT]; Dunn & Dunn, 2007), and had demographic characteristics consistent with that of the Southwestern Ontario population (Statistics Canada, 2017). This study was approved by the University of Western Ontario Health Sciences Research Ethics Board. The primary caregivers provided consent for their participation, as well as their child's participation, in this study. There were missing data for family income (n = 3) and PPVT (n = 2) scores at T1, and one child was missing Child Behavior Check List (CBCL; Achenbach & Rescorla, 2001) questionnaire measures at T2.

2.2 Measures

Laboratory ratings of BI, EC, and Dominance

BI, EC, and dominance were assessed via the Laboratory Temperament Assessment Battery (Lab-TAB; Goldsmith et al., 1995) tasks at age 3 and age 5-6. The Lab-TAB is a battery of standardized, developmentally appropriate tasks designed to elicit individual differences in early emotion and behaviour (e.g., Liu et al., 2021; Liu et al., 2019; Mumper et al., 2019; Olino et al., 2018). Children participated in a total of 12 tasks from the Lab-TAB during their laboratory visit, which lasted approximately 1.5-2 hours, and all tasks were video-recorded for coding. Each of the Lab-TAB tasks, described subsequently, is designed to elicit emotions such as positive affect, sadness/anger, or fear, although children typically exhibit several emotions during each task. Our use of the Lab-TAB has been described in greater detail elsewhere, both as a measure of emotionality (Durbin et al., 2005; Hayden et al., 2005) as well as behavioural inhibition and effortful control (Liu et al., 2019). Tasks are described below in the order in which they were administered. With each of the tasks, we note the traits they were primarily intended to elicit. Children's behaviour during these tasks were videorecorded and coded for facial, vocal and bodily expressions of BI and EC. We selected a subset of these tasks for coding dominance based on significant interpersonal interaction in the task.

Age Three Laboratory Assessment.

Risk room (BI). The child was left alone to play with a set of novel and ambiguous stimuli (e.g., a short staircase, a cloth tunnel, a mattress) for five minutes. Then, the experimenter returned to the room and asked the child to approach each object.

Tower of patience (EC, Dominance). The experimenter and child took turns building a tower using large cardboard blocks. The experimenter waited a series of increasing delays (5, 10, 15, 20, and 30 seconds) before placing her block on the tower, thus forcing the child to wait

increasingly longer periods of time before being given a turn. Two towers were built over the course of this task.

Puzzle with parent (Dominance). Based on the Teaching Tasks battery (Egeland et al., 1995), the primary caregiver and child were presented with a block puzzle designed to be challenging for young children and were instructed to work together to solve it. To enhance the perceived evaluative nature of the task, the dyad was told to place the pictures of completed puzzles in the upper corner of the work desk so that the experimenter could see how many they had finished upon her return (5 minutes later).

Stranger approach (BI). The child was left alone in the main experimental area. After a few moments, a friendly male research assistant (unknown to the child) entered the room and spoke to the child while gradually moving closer to him or her.

Jumping spider (BI). The child was introduced to a terrarium containing a fuzzy, fake, black spider. The experimenter asked the child to touch the spider; when the child came closer to the spider, the experimenter manipulated the spider using an attached wire, making it appear to jump. At the end of several trials, the experimenter showed the child it was a fake spider.

Snack delay (EC, Dominance). The experimenter placed a candy under a transparent cup and told the child that he/she must wait until the experimenter rang a bell before picking up the cup and eating the candy. The experimenter waited a series of increasing delays (5, 10, 20 and 30 seconds), forcing the child to wait longer with each trial to eat the candy.

Age Five Laboratory Assessment.

Exploring new objects (BI). The child and experimenter entered a room in which there were novel and ambiguous stimuli, including a tunnel, a remote-controlled spider, a skull and cloth, a box with a toy heart inside, and a box with rubber worms inside. The experimenter instructed the child to play with the objects in the room and then left the child alone for 5 minutes. When the experimenter returned, she asked the child to interact with each stimulus in the room.

Friendly stranger (BI). The child was left alone in a room with a toy, and an unfamiliar male research assistant entered the room. Following a standardized script, he asked the child friendly questions while gradually walking closer and asked to join the child in playing with the toy.

Object fear (BI). The experimenter instructed the child to investigate "something scary" in a pet carrier, then left the child alone in the room. After one minute, the experimenter returned and asked the child about the item in the animal carrier. If the child had not explored the carrier, the experimenter encouraged the child to look inside or put his or her hands in the carrier.

Simon says (EC). The child was asked to play a classic game of "Simon Says," where he or she was expected to imitate the actions of a video-recorded experimenter (e.g., rub their tummy) only when the command was preceded with the words "Simon says." Out of 40 trials, 20 were "motion" trials (i.e., commands presented with *Simon says)* and 20 were "still" trials (i.e., commands presented without *Simon says).*

Gift bag (EC). The child was left alone in a room with a gift bag for three minutes and was told not to touch the gift until the experimenter had returned with the child's parent.

Puzzle with parent (Dominance). The caregiver and child were seated at a table and presented with a bag of blocks that could be assembled in different ways to match pictures of figures on an accompanying set of cards. The experimenter instructed the dyad to recreate the figures on the cards one by one in whatever order they chose, and if they finished before the experimenter got back, to make a figure of their choice with the blocks.

Not sharing (Dominance). The experimenter and the child were seated at a table together. A research assistant entered the room and handed the experimenter a bag filled with candy, instructing her to share equally with the child, then left the room. The experimenter initially divided the candies equally with the child, but then began to give herself more candy than the child and finally took all the child's candy. At the end of the task, the experimenter acknowledged that she was not sharing fairly and gave the child half the candy.

2.3 Coding

BI

Microcoding was used to measure BI by segmenting tasks into epochs of 10, 20, and 30 seconds. The *Risk room* (T1) and *Exploring new objects* (T2) episodes shared similar coding schemes in which children were measured on their latencies to a) touch an object in the room, b) show an initial fear response, and c) engage in their first verbalization. Facial, vocal, and bodily fear were coded within each epoch on a scale of 0 (no fear) to 3 (high intensity fear). The *Stranger approach* (T1) and *Friendly stranger* (T2) tasks used similar coding schemes. Children were coded on their first fear response a) after being left alone in the experiment room, and b) when the stranger entered the room. Facial, vocal, and bodily fear were also coded for this task,

as well as approach and avoidance behaviour, gaze aversion, and amount of interaction with the stranger.

For the *Jumping spider* (T1) task, the child's latency to their first definite fear response and peak intensities of facial, bodily and vocal fear, as well as behaviours of approach, startle, gaze aversion, and withdrawal were coded. For *Object fear* (T2), children were coded on their latencies to a) first approach the carrier and b) first touch the carrier, and c) the tentativeness of these behaviours. Latency to first fear response, verbalization, and withdrawal attempt were also coded.

Scores for certain behaviours were reverse-coded so that higher scores in all tasks were indicative of higher BI. The final BI scales were comprised of an average score of z-transformed codes across different tasks (Age 3: $\alpha = .79$, $N = 39$; ICC = .71, $N = 32$; Age 5: $\alpha = .88$, $N = 67$; ICC = .98, $N = 24$).

EC

Tasks and coding schemes used to measure EC were adopted from Kochanska and colleagues (Kochanska et al., 1997; Kochanska et al., 2000; Kochanska et al., 1996). For both tasks at T1 (Tower of patience and Snack delay), failures to wait one's turn were counted in each trial. For *Simon says* (T2), raters coded whether children correctly engaged in the relevant behaviour following the command "Simon says" and refrained from engaging in the behaviour in the absence of this command. For *Gift bag* (T2), children were coded on their latencies to touch, peek, put their hand on, or pull a gift from the bag, or to get up from their seat. Children were also coded on the duration they stayed in their seat.

The final EC scales were comprised of an average score of z-transformed codes (and reverse-coded when necessary) across the Tower of patience and Snack delay tasks at Age 3 (α = .79, *N* = 39; ICC = .95, *N* = 32) and the Simon says and Gift bag tasks at Age 5 (α = .64, *N* = 80; ICC = .99, *N* = 31).

Dominance

To assess dominance, we selected tasks with significant interpersonal interactions for behavioral coding: the *Parent puzzle, Snack delay*, and *Tower of patience* tasks were used at the Age 3 visit, and the *Parent puzzle* and *Not sharing* tasks were used at the Age 5 visit. We coded these episodes using the Interpersonal Adjective Scales Revised (IAS-R), a 64-item self-report adjective list based the interpersonal circumplex model (Wiggins, 1979), which characterizes behaviour along two relevant axes: dominance/submissiveness and warmth/hostility (see Wiggins et al., 1988). Trained undergraduate and graduate student coders rated each child on each of the IAS-R adjectives (e.g., self-assured, boastful, bashful) on a scale from -2 (very untrue) to 2 (very true) for each task. The IAS-R adjectives can be reduced to eight interpersonal scales comprised of eight items each: assured-dominant, unassured-submissive, warm-agreeable, cold-hearted, arrogant-calculating, unassuming-ingenuous, gregarious-extroverted, and aloof-introverted. For the purposes of this initial validation study focused on dominance, we focused on the assured-dominant and unassured-submissive scales, which were aggregated into a single Dominance-Submissiveness scale with a total of 16 items (see Appendix A). Scales were averaged across tasks to create a final score on all scales for each participant. A subset of 12-20 children (20-34%; subset varied between tasks) were double-coded to assess inter-rater agreement for the dominance scale (Age 3 ICC: .70; Age 5-6 ICC: .79).

2.4 Child Symptoms

We used the preschool version (1.5-5 years of age) of the Child Behavior Checklist (CBCL; Achenbach & Rescorla, 2001) to assess child symptoms at both age 3 and age 5-6. The CBCL instructs the respondent to rate the frequency and intensity of any emotional or behavioural problems the child has experienced over the past 6 months on a 3-point scale (0 = *not true*, 1 = *somewhat or sometimes true*, and 2 = *very true or often true)*. The CBCL yields eight syndrome scales (Ivanova et al., 2007): aggressive behavior, anxious-depressed, attention problems, rule-breaking behavior, somatic complaints, social problems, thought problems, and withdrawn-depressed. Based on previous work implicating the role of excessive dominance in externalizing disorders, as well as submissiveness in anxious and depressed individuals (e.g., Gilbert, 1992; Gilbert, 2000), we focused on the broad internalizing subscale (a composite of anxious-depressed and withdrawn-depressed symptoms [Age 3: $N_{items} = 18$; $\alpha = .76$; Age 5-6: $N_{items} = 18$; $\alpha = .76$]), and the broad externalizing subscale (a composite of attention problems, rule-breaking, and aggressive behaviour [Age 3: $N_{items} = 45$; $\alpha = .87$; Age 5-6: $N_{items} = 35$; $\alpha = .84$]) of the CBCL.

3. Results

3.1. Descriptive Statistics

All major study variables and bivariate correlations are presented in Table 1. Family income was moderately positively correlated with child PPVT scores, and negatively correlated with children's internalizing symptoms on the CBCL at age 3, EC at age 3, and BI at age 5-6. Race was significantly associated with dominance at both time points, such that White children were more dominant than non-White children. However, due to the ethnic homogeneity of this sample (i.e., only 5 children were non-White), these results must be interpreted with caution.

Dominance showed moderate-to-large stability over a time interval of approximately 2.5 years based on the correlation between age 3 and age 5-6 dominance. In addition, children's internalizing and externalizing symptoms were highly correlated with each other at both time points. EC also showed moderate stability across time points, whereas BI at age 3 was not significantly associated with BI at age 5-6[2].

Examining bivariate correlations to characterize relationships between dominance and other temperament traits showed that, as hypothesized, age 3 dominance was moderately negatively correlated with concurrent BI (r = -.30). Age 3 dominance was moderately negatively correlated with EC across age 3 (r = -.33) and age 5-6 (r = -.35), also consistent with study hypotheses. Dominance was significantly correlated with child symptoms measured by the CBCL at both time points. More specifically, as hypothesized, dominance at ages 3 and 5-6 was negatively

[2] This result is somewhat unexpected given that BI was relatively stable (r=.28, p<.01) in the larger sample of 409 children (e.g., Liu et al., 2019; Kotelnikova et al., 2015).

correlated with concurrent internalizing problems (r = -.32 at age 3, r = -.26 at age 5-6). Contrary to our hypotheses, externalizing problems and dominance were unrelated either prospectively or concurrently and age 5-6 dominance was not significantly correlated with concurrent BI and EC.

3.2. Differences between Boys and Girls[3] on Dominance

Independent samples t-tests were used to compare dominance between girls and boys at both time points (see Table 2); we also examined differences between boys and girls on other temperament traits for basis of comparison. Means and standard deviations were used to compute Cohen's *d*. At age 3, there was a trend-level difference between girls and boys with respect to dominance, with boys exhibiting higher dominance (d = .47). At age 5-6, boys were significantly more dominant than girls (d = .62). There was a similar pattern with respect to BI, such that boys and girls differed in BI only at the age 5-6 assessment, with boys being less inhibited than girls (d = .62). Conversely, in the case of EC, girls had higher EC than boys at age 3 but not at age 5-6 (d = .55).

[3] Because parents indicated via questionnaire whether their three-year-old children were boys or girls, we refer to "sex" when describing the specific construct measured in the current study.

Table 1.

Bivariate Correlations among Major Study Variables

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Child sex	-	-.14	-.31*	.17	-.05	-.23	-.30*	.34**	.05	.17	-.10	.09	.27*	.30*	.20
2	Child age at Age 3		-	.13	.00	.17	.08	.06	.02	-.10	-.24	-.26	-.23	.17	-.33*	.21
3	Family Income			-	-.07	.30*	.20	.21	-.33*	-.10	-.13	-.05	-.04	-.31*	-.28*	-.08
4	Race				-	.07	-.34**	-.35**	.37**	.10	.35**	.18	.13	.10	.11	.15
5	PPVT					-	.06	-.01	-.01	-.16	.04	-.29*	-.25	.15	-.23	-.06
6	Dom at Age 3						-	.56**	-.32*	-.07	-.02	.12	-.30*	-.33*	-.04	-.35**
7	Dom at Age 5-6							-	-.45**	-.21	-.26*	.01	-.21	-.20	.19	-.08
8	CBCL Int at Age 3								-	.41**	.40**	.07	.36**	.33*	-.08	.05
9	CBCL Ext at Age 3									-	.11	.46**	.07	-.03	-.10	.05
10	CBCL Int at Age 5-6										-	.39**	.08	.07	.11	-.15
11	CBCL Ext at Age 5-6											-	.06	-.40**	.17	-.12
12	BI at Age 3												-	-.01	.07	.09
13	EC at Age 3													-	.07	.39**

14	BI at Age 5-6														-	.06
15	EC at Age 5-6															-
16	N	58	58	55	58	56	58	58	58	58	57	57	58	58	58	58
17	Mean	1.52	3.46	3.95	.09	11	.18	.13	.36	.71	.39	.60	-.03	.50	-.00	.41
18	SD	.50	.29	1.01	.28	12.9	1.65	.63	.34	.50	.32	.45	.33	1.81	.47	4.1

Note. $^{**}p < .01$; $^{*}p < .05$; Child sex: boys = 1, girls = 2; CBCL = Child Behavior Checklist; Int = Internalizing subscale; Ext = Externalizing subscale; BI = Behavioural inhibition; EC = Effortful control.

Table 2.

Boys' and Girls' Dominance, BI, and EC at Age 3 and Age 5-6.

		Boys		Girls		*t*(56)	*p*	Cohen's *d*
		M	*SD*	*M*	*SD*			
1.	Age 3 Dominance	.57	1.56	-.19	1.67	1.77	.08	.47
2.	Age 5-6 Dominance	.74	1.22	-.06	1.36	2.35	.02	.62
3.	Age 3 BI	-.06	.36	-.01	.31	-.66	.51	.17
4.	Age 5-6 BI	-.15	.33	.13	.54	-2.35	.02	.62
5.	Age 3 EC	.00	2.14	.96	1.23	-2.07	.04	.55
6.	Age 5-6 EC	-.43	4.57	1.19	3.47	-1.53	.13	.40

Note. BI = Behavioural inhibition; EC = Effortful control

4. Discussion

The DBS has been linked to an array of important outcomes; however, although dominance has been studied in children's peer groups (e.g., Hawley, 2002; Pelligrini & Long, 2002), little is known about its early development from an individual differences perspective. With the goal of informing future studies of the development of this important construct, we examined the utility of an observational method for assessing dominance, a key component of the DBS, in early childhood. Our findings provide support for observational ratings of children's dominance using laboratory paradigms, showing that dominance assessed in this way shows stability comparable to more widely studied child temperament traits assessed observationally (e.g., Durbin et al., 2007) and via parent report (Olino et al., 2013). Our laboratory-based observational method allowed us to observe individual differences in child behaviour in standardized contexts likely to elicit DBS-related behaviour, as well as the opportunity to objectively code these behaviours, which are strengths that observational measures of child temperament have over more commonly used parent-report measures (Liu et al., 2019, Hayden et al., 2005).

We found that laboratory-assessed dominance was moderately stable over a time period of approximately two years across the ages of 3 to 5-6 in a community sample of children. Considered in contrast to parent report, the stability we found using laboratory ratings (r=.56) is especially impressive. Specifically, the laboratory tasks used to measure dominance differed at each time point in order to be developmentally sensitive and novel to the children; the independence of the tasks, combined with the fact that the coders themselves differed for the two waves of coding, would be expected to reduce stability relative to parent reports, which capitalize on the stability of both test items and raters (i.e., parents), in addition to true trait stability. In addition, the tasks used in the current study were drawn from established, validated

batteries; while the use of such batteries is a strength of the study that should allow for extent datasets to be coded for dominance, the tasks were not designed specifically to elicit dominance behaviour. It is possible that developing and using tasks specifically designed to elicit child dominance might demonstrate even greater stability of early dominance.

Our measure of child dominance was correlated with other temperament traits in ways that are consistent with existing theories and research. First, age 3 dominance and BI were negatively correlated. Given that BI is characterized by low approach behaviours (Fox & Pine, 2012), its negative association with dominance, a construct which has been characterized by spontaneously engaging in social competition (Cohen et al., 1996), behaving assertively, and controlling the actions of others (Buss & Craik, 1980), is unsurprising. Demaree and colleagues (2005) examined associations between neurobiological indices of the behavioural inhibition and activation systems (BIS/BAS) and perceptions of socioemotional interactions, measured through film clips of individuals exerting dominance or submissiveness over another person. These researchers found that individuals who identified with the submissive character scored significantly higher on BIS sensitivity, suggesting that individuals with this sensitivity may have biased perceptions of interpersonal interactions that may lead to an increased sense of submissiveness. These findings, though based on neuropsychological and self-report indices, are consistent with our behavioural findings of the small, but significant negative relationship between dominance and BI.

Consistent with past work on the DBS in adults (Johnson et al., 2012), our measure of dominance was associated with children's internalizing symptoms, supporting the relevance of this construct in developmental psychopathology. More specifically, depressive and anxious symptoms were negatively correlated with concurrent dominance at age 3 and age 5-6. Some

conceptualizations of depression emphasize the role of excessive social comparison and the tendency to view oneself as inferior or subordinate (Swallow & Kuiper, 1988), or that it reflects the inability to recover from submissive experiences (Sloman, 2000; Gilbert, 1992). Though most of the work linking the DBS and depression has focused on adults, some retrospective research has found that depressed adults are more likely to report experiences of shame, subordination, and submissiveness during childhood (Gilbert et al., 2003). In fact, experiences of subordination, shame, and submissiveness are more strongly associated with depression than experiences of guilt or sadness (Gilbert et al., 2009; Harder & Zalma, 1990). Social anxiety disorder in particular is thought to reflect a hypersensitivity to social rejection (Trower & Gilbert, 1989); within this framework, a socially anxious individual will engage in submissive behaviours in order to avoid possible rejection or ostracism (Johnson et al., 2012). Several studies have shown positive cross-sectional correlations of anxiety with self-reported submissiveness (e.g., Allan & Gilbert, 1997; Gilbert, Broomhead, et al., 2007; Gilbert, McEwan, et al., 2009), behavioral indicators of submissiveness among adults (Weeks et al., 2011, 2016; Galili et al., 2013), and retrospectively reports of child submissiveness (e.g., Castihlo et al., 2014); however, to our knowledge, no previous studies have examined these associations during childhood. Due to the correlational nature of this study, we cannot assign causal status to the DBS as a risk factor for these disorders; however, our findings suggest that there is an association between dominance and anxiety even in early childhood and support the relevance of studying the early development of the DBS in relation to psychopathology.

In addition to its negative correlation with BI, dominance at age 3 was negatively correlated with EC at ages 3 and 5-6. Conceptually, the negative correlation between dominance and EC (such that higher dominance is associated with lower EC) is consistent with the fact that

behavioral expressions of low dominance are likely similar to those seen in children with higher EC (e.g., a greater capacity to delay turn-taking when playing games with others). EC is thought to have a central role in successful interpersonal functioning as it allows individuals to inhibit self-focused impulses in consideration of others and of social norms (Vohs & Ciarocco, 2004). Individuals scoring on the extreme ends of EC are at risk for interpersonal problems; low EC has been associated with social difficulties related to intrusiveness and disinhibition, and high EC is associated with the tendency for individuals to be "overregulated" or withdrawn in social interactions (Cain et al., 2013). Very little research has examined the relationship between EC and dominance per se; however, both low EC and high dominance are implicated in externalizing disorders (Johnson et al., 2012; Eisenberg et al., 2005).

Although we did not find that dominance was meaningfully related to externalizing disorders in our study, significant externalizing problems were not present in this community sample, limiting our ability to detect associations between externalizing behaviors and dominance. In addition, the types of externalizing symptoms we assessed should be considered. Previous work has focused largely on adults and has suggested that excessive dominance is implicated in several externalizing syndromes of *adulthood* (Stanton et al., 2017; Johnson et al., 2012), including psychopathy, antisocial personality disorder, substance use disorders, and narcissism, with little work on associations between the DBS and childhood externalizing syndromes. It is possible that the relevance of the DBS to externalizing problems emerges later in development, or in interaction with other core environmental or temperament features. As we follow these children into mid-to-late childhood and adolescence, we will have the opportunity to observe the potential development of these behaviours in relation to the DBS.

The negative correlations observed between concurrent BI/EC and dominance at age 3 were not observed at age 5-6. More specifically, age 5-6 dominance was unrelated to age 5-6 BI or EC. This could be due to the increased differentiation that occurs in child temperament with age (Shiner, 1998). This tendency implies that reliably attributing child behaviors to specific temperament traits is more challenging in younger children, which could mean that expressions of behaviour influence rafters' perceptions of multiple traits. For this reason, BI, EC, and dominance may appear more closely related earlier in development. Future studies that aggregate ratings of dominance across many contexts to reduce "noise" in assessments of dominance may be needed to better tap linkages between conceptually distinct traits.

Consistent with the existing social dominance literature (e.g., Charlesworth & Dzur, 1987; Neppl & Murray, 1997), we found that boys tended to be more dominant than girls at age 3 and were significantly more dominant than girls at age 5-6[4]. Given the negative associations of BI and EC with dominance as described above, these results fit with findings that boys are less fearful and lower in EC than girls (Olino et al., 2013). While the reason for these differences in dominance is unclear, this finding is consistent with the possibility that socialization processes become increasingly more important determinants of dominance as children age. Of import, observational approaches to studying sex and gender differences in temperament may be less influenced by sociocultural expectations of gender (i.e., as compared to self- or parent-report), highlighting the strength of this method in addressing research questions focusing on temperamental differences between males and females.

[4] The Dominance-Submissiveness scale showed adequate variability in both boys and girls.

In order to make broad claims about the predictive validity of trait dominance, it must be distinguished from near-neighbour constructs such as BI and EC, as well as other related temperament traits such as extraversion and aggression. The current study provides preliminary support towards this goal by demonstrating that, while there are significant, meaningful relationships between dominance, BI, and EC in children, they are not completely overlapping constructs. More sophisticated analyses, such as exploratory factor analysis (EFA), should be used in future observational work with larger samples to precisely identify the overlap for dominance and related constructs. This would entail developing a broader conceptualization of the DBS in children and coding a broader, more exhaustive range of observable dominance behaviours. Recent work from Tang-Smith et al. (2015) indicated that the DBS could be captured by six factors: Comfort with Leadership, Ruthless Ambition, Cooperation, Influence/Power, Authentic Pride, and Hubristic Pride, and that that these facets had differential links with psychopathology. For example, depression and anxiety were associated with lower Influence/Power, lower Authentic Pride, and higher Hubristic Pride. This study, as well as Tharp et al. (2021)'s most recent replication and extension of these findings, provide a novel conceptualization of the DBS in adulthood; although it may prove challenging to assess some of these facets of dominance in young children, this work may help guide the development of a richer, more nuanced conceptualization of the DBS in childhood. While recommendations for sample sizes necessary to conduct EFAs vary widely (e.g., 100 participants by Kline et al. [1994]'s standards; 300 by Tabachnik & Fidell [2001]'s) and are dependent on a number of factors (e.g., the strength of intercorrelations amongst variables and the extent to which variance in variables is explained by latent factors; MacCallum et al., 1999), we aim to code DBS in larger samples of children in our ongoing research on the DBS.

Similarly, multi-method assessment of the DBS, including the corroboration of parent- or teacher-report with observational data, is a goal of future study. To our knowledge, there is no validated parent- or teacher-report for the DBS. The self-rated *Dominance Behaviour System Scale* (Tang-Smith et al., 2015) is a factor-analytically derived scale covering six facets of the DBS, but it is not clear whether this scale is developmentally appropriate for use in young children, even if assessed with informant report. The development of multi-method assessment measures will help determine the convergent validity of the observational method for assessing the DBS.

The current study had a number of strengths, including the use of a longitudinal design, lab-based observational measures, and the use of a reliable and previously validated measure of interpersonal behaviour (IAS; Wiggins et al., 1988). This study was also the first to look at trait dominance specifically in children, contributing to an understanding of the trait's early development and associations with related constructs in early life. However, this study also had several limitations. First and foremost, because our goal was to explore the initial validity of a coding system, we used a relatively small sample of children. Given that the findings from this pilot study support the utility of this method, future work should extend these findings by using larger samples. In addition, while our lab-based measures did elicit DBS-related behaviour, the tasks used were not specifically designed to measure the DBS. This constrained our ability to directly tap dominance motivation, dominance behaviour, and responsiveness to power, which were originally described as individual facets comprising the DBS construct (Johnson et al., 2012). Nonetheless, our system of rating episodes from a commonly used measure enhances the ability to apply these ratings within other studies. Additionally, using tasks that do not demand dominant behaviour may provide a context in which children's variability on this trait is more

readily apparent. Our findings support the potential of the DBS in furthering our understanding of the interplay between temperament and psychopathology. This study showed that an observational coding system for the DBS exhibited construct validity in a sample of young children as evinced by moderate to large stability of the trait over a two-year follow-up interval. Dominance was also related to other temperament and symptom constructs in ways that were generally consistent with theory and existing evidence in adults (Johnson et al., 2012). This work lends support for observational measures as a valid measurement approach for assessing the DBS, and it is our hope that future work will incorporate multimethod approaches of the DBS across development.

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Appendix A

Items on Dominance-Submissiveness Scale

Self-assured

Self-confident

Assertive

Persistent

Firm

Dominant

Forceful

Domineering

Timid

Bashful

Shy

Meek

Forceless

Unauthoritative

Unbold

Unaggressive

Curriculum Vitae

Name: Jennifer Mullen

Post-secondary Education and Degrees:

Western University
London, Ontario, Canada
2019-2021, M.Sc. Candidate, Psychology

McMaster University
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Honours and Awards:

Western University
Ralph S. Devreux Award in Psychology ($1800)
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Children's Health Research Institute (CHRI)
Graduate Research Fellowship ($10,000)
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Western University
Western Graduate Research Scholarship (WGRS)
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McMaster University
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Related Work Experience

Graduate Teaching Assistant
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Peer-Reviewed Publications:

Mullen, J.N., Liu, P., McDonnell, C.G., Stanton, K., Johnson, S., & Hayden, E.P. (2021). *Development and validation of a coding system for the dominance behavioral system in early childhood.* Submitted for publication.

Amani, B., Schmidt, L. A., **Mullen, J. N.**, & Van Lieshout, R. J. (2020). Right frontal brain activity at rest in the early 20's predicts threat-related bias ten years later among extremely low birth weight survivors. *Neuroscience Letters*, 135012.

Poole, K. L., Khalesi, Z., Rutherford, M.D., Swain, A., **Mullen, J.N.**, Hall, G.B., & Schmidt, L.A. (2020). Personality and opponent processes: Shyness, sociability, and visual afterimages to emotion. *Emotion, 20*(4), 605–612.

Poster Presentations:

Mullen, J., Liu, P., McDonnell, C.G., Stanton, K., & Hayden, E.P. (2021). *Validating an observational coding system for the Dominance Behavioural System (DBS) in children.* Poster presentation at the Society for Research in Child Development.

Mullen, J., Amani, B., Van Lieshout, R., Schmidt, L.A. (2019). *Right frontal brain activity in early 20's predicts threat-related biases in early 30's: understanding developmental programming of psychopathology*. Poster presentation at the Society for Research in Psychopathology, Buffalo, NY.

Khalesi, Z., Swain, A., **Mullen, J.**, Jin, J., Schmidt, L., & McNeely, H. (2019). F127. The pursuit of happiness: how happiness mediates the relation between shyness and quality of life among adults with schizophrenia. *Schizophrenia Bulletin*, *45*, S302-S302.

Mullen, J., Markoulakis, R. & Levitt, A. (2017). *Supporting individuals with mental health and addictions issues through navigation.* Oral presentation at the Canadian Psychological Association National Convention, Toronto, ON.

Mullen, J, Markoulakis, R. & Levitt, A. (2017). *What is navigation in the care of mental health and addictions?* Oral presentation at the 43rd Harvey Stancer Research Day, Toronto, ON.

Mullen, J, Rieder, A. & Hall, G**.** (2017). *Reliability and Validity of the International Psychiatric Mobile Assessment for Children and Teens (IMPACT).* Poster presentation at McMaster Psychology, Neuroscience and Behaviour Thesis Fair, Hamilton, ON.

Mullen, J, Markoulakis, R. & Levitt, A. (2016). *Supporting individuals with mental health and addictions issues through navigation.* Poster presentation at the D+H SRI Summer Student Research Program, Sunnybrook Health Sciences Centre, Toronto, ON.